

INTERNATIONAL UNIVERSITY OF AFRICA

KHARTOUM, SUDAN

**A THESIS FOR Ph. D DEGREE SUBMITTED TO THE
DEANSHIP OF GRADUATE STUDIES, SCIENTIFIC
RESEARCH AND PUBLICATION**

TITLED:

***“ANALYSIS OF SOCIOECONOMIC IMPACTS OF FLASH
FLOODS OVER ADAMAWA STATE, NIGERIA (2004 - 2016)”***

BY

YUSUF UMAR AHMAD

Supervised by

Professor Abdel Malik Gasm El Seed Mohamed

August, 2017

INTERNATIONAL UNIVERSITY OF AFRICA

KHARTOUM, SUDAN

A THESIS FOR Ph. D DEGREE SUBMITTED TO THE

DEANSHIP OF GRADUATE STUDIES, SCIENTIFIC

RESEARCH AND PUBLICATION

FACULTY OF ARTS, DEPARTMENT OF GEOGRAPHY

TITLED:

***“ANALYSIS OF SOCIOECONOMIC IMPACTS OF FLASH
FLOODS OVER ADAMAWA STATE, NIGERIA (2004 - 2016)”***

BY

YUSUF UMAR AHMAD

(B. Sc., M. Sc. Geography, Bayero University Kano – Nigeria)

Supervised by

Professor Abdel Malik Gasm El Seed Mohamed

August, 2017

DECLARATION

I hereby declare that this thesis titled “*Analysis of Socioeconomic Impacts of Flooding on the Communities along the Floodplains of River Benue in Adamawa State, Nigeria*” has been written by me and that is a record of my own research work. It has not been in anyway accepted to my knowledge in a previous application for higher degree in any institution. All the sources of information are specifically acknowledged by means of reference

CERTIFICATION

I certify that this thesis is written by **Yusuf Umar Ahmad** in partial fulfillment for the award of the degree of Doctor of Philosophy in Geography in the Department of Geography, International University of Africa, Khartoum - Sudan.

Professor Abdel-Malik G Seed

.....

.....

(Supervisor)

Date

Signature

.....

.....

.....

(Internal Examiner)

Date

Signature

.....

.....

.....

(External Supervisor)

Date

Signature

DEDICATION

I dedicate this work to my parents late Mal. Umaru Mai Shanu (Kawu) and Hajiya Halima Musa (Hajiya Adda) for their parental care, counseling, moral upbringing, prayers as well as financial supports offered to me since my early school days up to the time I found myself within the four walls of University. May Allah (SWT) reward the abundantly and forgive their shortcomings, *Ameen*.

ACKNOWLEDGEMENTS

I wish to express my profound gratitude to Allah (SWT) the Lord of the worlds, the Sustainer of the Universe and the Provider of all things. He taught the mankind by the pen and He taught him what he knew not. His bounties, mercies and blessings upon His creatures are uncountable. May His benedictions be upon His servant and the seal of all prophets Muhammad (SAW), as well as all other prophets, his household, companions and those that follow them in righteousness until the day of Accountability. I thank Him for sparing my life and granting me the opportunity to come to the International University of Africa, Khartoum Sudan to enroll my doctorate degree in Geography.

I want to register my sincere appreciation and gratitude to my supervisor ***Professor Abdel-Malik G. Seed*** for his patience in going through the work over and over in spite of his age and tight schedules. I also thank him for the immeasurable assistance in form of comments, suggestions and caring without which this work would have not been in this fashion. I am grateful for everything, thank you sir. Secondly, I must appreciate Mal Danjuma Muhd of the Department of English, Federal University, Kashere (FUK) for editing the work in spite of his tight schedules, May Allah reward you abundantly.

I must also thank my employer, **Gombe State University** for granting me study fellowship during the course of my study at the International University of Africa, Sudan. I thank you very much for the gesture. I cannot forget my mentors and caring fathers: The Incumbent Vice Chancellor of Gombe State University Professor Ibrahim Musa Umar and the former professor Abdullahi Mahadi for their supports and counseling.

I profoundly express my appreciation to the Chief Imam of GSU Sheikh Dr. Dahir I. Ibrahim, Dr. Rasheed Abdul Gany, Dr. T.J, Dr. Seydou Hankrou, A. M Yelwa (, Danladi A. and Ishaq A. I cannot forget my friends and neighbours in Sudan such as Dr Abdulkadir Saleh, Mal Abubakar Shehu Umar (FCE T), Mal Yahya Bello, Mal Sulaim S. Gumi, Mal Salihu Dauda, Mal Habeeb Muhd, to mention but a few, for their moral support and good wishes.

My deep appreciation also goes to my intimate friends Dr. Gambo Idris (FCE, Kano) who throughout remained my host whenever I come to Kano and Mal. Musa Aliyu (NNPC, Benin) for their huge wonderful financial supports and encouragements. May Allah (SWT) reward you here and in the Hereafter. I cannot forget yet another bosom friend of mine in person of M. Auwal Adamu (FIN Bank, Dutse), for his encouragements. Similarly, I thank Mal Abubakar Shehu Umar FCE (T) Gombe and Dr. Ibrahim Audu (FUK) for their wonderful reception and entertainment for my first three days in Khartoum.

Finally, I must express my special thanks to the members of our family, especially my mother Hajia Adda, my elder sister Hajia Lami and my younger brothers and sisters such, Asabe, Damjuma, Khamis, Hawwa, Salma, Binta and Amina. Similarly, I appreciate the concern and patience of my beloved wife Zainab and our children (Umar Alfarouq, Sa'imah, Muhd Attahir, Hamida II and Khaleel). They deserved to be commended for their patience, prayers and support during my stay in Khartoum Sudan for this Ph. D programme.

Thank you all and may Allah (SWT) bless us all.

Yusuf Umar Ahmad.

August, 2017

Abstract

Flood disasters remain the common and widespread of all natural hazards in the world and in the floodplains of Adamawa State in particular. The consequences flooding are so enormous both on physical and socioeconomic well-being of the inhabitants. In the study area for example, over 302,200 people were reported to have been affected with many lives lost due to flood menace in recent times. Seven local government areas out of the 21 were purposively selected, and from each, four communities were randomly selected as the sample for the study. 57 questionnaires were administered to each of these communities. Therefore, a total of 400 questionnaires were administered using Singha, (2002) formula, but 383 were retrieved. In addition, Focus Group Discussions (FGD) of 7-10 participants aged between 25 and 65 years was conducted in five communities randomly selected. The FGD interaction took place in vernacular (Hausa language) which was the second lingua franca of most of the communities and then later translated into English language. Also, other sources of secondary data include records from the Adamawa State Emergency Management Agency (ADSEMA), National Environmental Management Agency (NEMA), Federal Ministry of Environment (FME) and State Ministry of Environment (SME). SPSS 16.0 and Microsoft Excel 2010 soft-wares were used in coding and analyzing the data in form of frequency, percentages, correlation, charts and graphs in order to make meaning out of it. Arc view GIS 3.2a was also used in the overlay analysis. The findings of research indicate that torrential rainfall cause by climate change was the major factor responsible for the flood disaster in the study area especially that the mean annual rainfall in the years 2009, 2012, 2013 and 2014 ranged between 88.4mm to 90.4mm; which was higher than what was obtained in the previous decades. However, this is connected with global warming which is responsible for the extreme storms in most of the Sub Saharan African countries. Similarly, the results show how floods strangulated socioeconomic activities of the affected communities in terms of displacement, ill health and sanitary, loss of farmlands/farm produce, destruction of houses, etc. The result of the product moment correlation on the other hand shows that there is correlation between rainfall intensity and flooding ($r=1.6622$). Similarly, there is correlation between torrential rainfall and flooding and between topography and flooding which were 0.16929 and 0.9944 respectively. The implication of the findings is that proactive measures should be taken to with view to checkmating flood disasters, so that the area will not continue to suffer from the challenges. Finally, based on the findings of the research, recommendations were made as how flood disaster will be ameliorated.

TABLE OF CONTENTS

	Page
CHAPTER ONE	
RESEARCH STRATEGY	
1.1 PREFACE	1
1.2 STATEMENT OF THE RESEARCH PROBLEM	7
1.3 JUSTIFICATION OF THE STUDY	8
1.4 RESEARCH QUESTIONS	10
1.5 RESEARCH HYPOTHESES	10
1.6 ASSUMPTION OF THE STUDY	11
1.7 AIM AND OBJECTIVES OF THE RESEARCH	11
1.8 SCOPE AND DELIMITATION OF THE STUDY	12
1.9 OPERATIONAL DEFINITIONS OF TERMS	12
CHAPTER TWO	
THEORITICAL FRAMEWORK AND REVIEW OF THE RELATED LITERATURE	
2.1 Introduction	16
2.2 Some Theories Governing the Occurrence and Factors of Floods	18
2.3 An Over View of Major Types of Flood	21

2.4 Impacts of Flooding	25
2.5.1 <i>Physical/Environmental Impacts</i>	26
2.5.2 <i>Social Impacts of Floods</i>	27
2.6 Global Strategies for Mitigating Flood Hazards	30
2.7 Efforts of the Federal Government's Agencies on Flood Disaster Management in Nigeria	32
2.8 Causes of Flood Hazards	35
2.9 Flood Disasters: The Global Context	44
2.10 Flood Disaster Profile in Africa	47
2.11 Spatio-temporal Distribution of Flood Disasters in Nigeria	49
2.12 Incidence of Flooding over the Northeastern Nigeria	60
2.13 Adamawa Flood Events	64
2.14 The Adamawa 2015 and 2016 Flood Scenarios	66
2.15 River Benue: The Major Source of the Flooding Waters	67
2.16 Lagdo Dam: The History, Climate and Morpho-hydrolic Characteristics	71
2.17 Recent Researches on Flooding in Nigeria and Issues Arising from the Literature Review	74

CHAPTER THREE
METHODOLOGY

3.1 Introduction	75
3.2 Research Design	75
3.2.1 <i>Sources and Types of Data</i>	75
3.2.2 <i>Reconnaissance Survey and Field Observation</i>	75
3.2.3 <i>Population and Sampling Technique</i>	77
3.2.4 <i>Focus Group Discussion</i>	80
3.2.5 <i>Other Sources of Secondary Data</i>	81
3.2.6 Research Assistants	81
3.3. Image Classification Processes	82
3.4 Data Presentation and Analysis	83
3.5.0 Geography of the Study Area	85
3.5.1 Introduction	85
3.5.2 Position, Location and Size	85
3.5.3 Population	86
3.5.4 Topography, Geology and Hydrology	90
3.5.13 Relief	93
3.5.14 Drainage	93
3.5.4 Weather and Climate	94
3.5.5 Temperature	95
3.5.6 Relative Humidity	96
3.5.7 Winds	96

3.5.8 Soils and Vegetation	97
3.5.9 Land Use Types	98
3.5.10 Economic Activities	99
3.5.11 Tribes	99
3.5.12 Mineral Resources	100
3.5.15 Environmental Problems	100

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction	101
4.2 Background Information of the Respondents	102
4.3 Length of Stay	102
4.4 Sex	103
4.5 Age Structure	104
4.6 Marital Status	105
4.7 Educational Level	106
4.8 Occupation/Employment of the respondents	108
4.9 The Extent and Magnitude of Flooding in the Study since Last Decade	109
4.10 Major Factors Responsible for Frequent Flood Disasters in the Affected Areas of the State	116
4.11 Rainfall Characteristic of Adamawa State between 2004 and 2014	122
4.12 Relationship between Physical Factors Responsible for Flooding and Socioeconomic Activities of the Affected Communities in the Study Area	124

4.13 Health and Sanitary Conditions	126
4.14 Shelter and Housing	127
4.15 Education	127
4.16 Farmlands Destroyed	128
4.17 Destruction of Infrastructural Facilities	130
4.18 Impact of flooding on Agriculture According to WHO	131
4.19 Risk of Acute Food Insecurity by September 2013 OCHA, 2012	133
4.20 Overview of the Government of Nigeria's funding for the 2012 Flood	134
4.21 Adaptation and Coping Strategies to Flooding	135
4.22 Responses for Rural Coping Strategies	136
4.23 Flood Early Warning Systems (FEWSs) Prior to Flood Disasters	138
4.24 Magnitude of Flooding based on the Responses	140
4.25 Assistance to Flood Victims	141
4.26 Federal Government's Assistance to Adamawa Flood Victims	126
4.27 FG Disburses Billions of Naira to Flood Victims	143
4.28 International Donors	144
4.29.1 UNFPA Donates to Adamawa Flood Victims	144
4.29.2 Red Cross and Red Crescent action	144
4.30 Present Government Efforts and Institutional Approach in Tackling Flood Disaster in Nigeria	145
4.31 Flood Vulnerability based on Social Group	146
4.32 Presentation of the Research Hypotheses	149
4.33 Mitigation Strategies	153

CHAPTER FIVE

DISCUSSIONS OF RESULTS

5.1 Introduction	157
5.2 Discussions of Results	157

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction	159
6.2 Summary	159
6.3 Limitations of the Study	160
6.4 Some Implications of the Findings	161
6.5 Conclusion	161
6.6 Recommendations	162
6.7 Suggestions for Further Studies	164
REFERENCES	165
APPENDICES	177
LIST OF ACROMYMS	194

LIST OF TABLES

Table 1: The Types of Floods Based on their Duration and Impacts	24
Table 2: The Top 20 Countries Ranked in terms Current Exposure to Flooding	60
Table 3: Information on the Number of Communities Affected by the 2012 Flood	64
Table 4: Spatio-temporal Distribution of Significant Floods in Adamawa State	65
Table 5: The 2006 Population Figures and Projection of 2015 for the Study Area	78
Table 6: The Coordinates, Elevation and Number of Instruments Administered	79
Table 7: The Population Figures of Adamawa State	87
Table 8: Mean Annual Climatic Conditions in Yola for Eleven Years	97
Table 9: The Length of Stay of the Respondents in the Study Area	102
Table 10: Sex Composition of the Respondents	104
Table 11: The Age Structure of the Respondents	105
Table 12: Marital Status of the Respondents	106
Table 13: The Educational Level of the Respondents	107
Table 14: Occupation/Employment of the Respondents	109
Table 15: Responses on the Magnitude of Floods (1994-2004) and (2004-2016)	112

Table 16: The Communities in each of the Terrain Zones	113
Table 17: Respondents' opinion on the causes of floods in the area	117
Table 18: Mean Annual Rainfall, Temperature and Relative Humidity of Yola	127
Table 19: Number of People, Livestock, Injured and Death Caused by Flood	126
Table 20: The Number of Farmlands and Livestock Destroyed	129
Table 21: The Number of Markets, Mosques, and Churches Destroyed	131
Table 22: Responses on early warnings prior to disasters from relevant agencies	140
Table 23: Magnitude of recent floods in the area (2004-2016) compared with what was obtained in the last decade	141
Table 24: Responses on the Efforts of Agencies of Flood Disaster	142
Table 25: The Social Group Mostly Affected by Flood Disaster	148

LIST OF FIGURES

Figure 1: Map of the Study Area Showing the Source of Lagdo	39
Figure 2: The concentric 8-step model for flood factors	44
Figure 3: The Map of Nigeria Showing River Benue and other Drainage	68
Figure 4: channels of data collection	84
Figure 5: Map of Adamawa State Showing LGAs	88
Figure 6: Map of Adamawa State Showing the Study Areas	89
Figure 7: Drainage Network of Adamawa State	90
Figure 8: Bar Graph Showing the Educational Level of the Respondents	108
Figure 9: Occupation/Employment of the Respondents	109
Figure 10: Flood Risk along River Benue in Adamawa State	111
Figure11: Communities More Vulnerable To Flood along River Benue	114
Figure 12: Showing the DEM and Flood Risk Areas in Adamawa State	119
Figure 13: Showing the Contour Map of Adamawa State	120
Figure 14: Bar Graph Showing Mean Annual Rainfall of Yola	123
Figure 15: Venerability floods based on Social Group	148
Figure16: Graph Showing Correlation between Rainfall Intensity and Flooding	149

Figure 17: Correlation between Torrential Rainfall and Release of Water	150
Figure 18: Relationship between Refuse Dumping and Flooding	151
Figure 19: Correlation between Torrential Rainfall and Release of from Dam	152
Figure 20: Relationship Topography between and Flooding	153
Figure 21: Summarized Views on Rural Coping Strategies of Floods	155
Figure 22: Summarized Views on Urban Coping Strategies of Floods	156

LIST OF PLATES

Plate1: The researcher Under Numan Bridge along River Benue	
Interviewing local residents near the bridge (February, 2016)	69
Plate 2: Risk Settlements along the Confluence of River Niger and Benue	70
Plate: 3 Satellite image of normal Niger-Benue Trough (October, 20 th 2008)	70
Plate: 4 Satellite image of the expanded Niger-Benue Trough due to erosion	
(October, 20 th 2012)	71
Plate 5: The Researcher during an interview with some residents at Zango, Yola	77
Plate 6: River Benue during dry season, February, 2016	92
Plate7: A settlement along floodplain before flooding, at Hayin Gada Numan	115
Plate 8: A man trying to escape death from 2015 flood disaster around Numan	115
Plate 9: How a culvert converted into a refuse dump in Zango, Tsohuwar	
Mayanka, Yola	117
Plate10: How a completely refuse buried culvert was cleaned to enable free	
flow of water in Jimeta	117